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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/662,316	09/16/2003	Chan Young Park	K-0541	1791

34610 7590 06/22/2006

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EXAMINER	
CHANG, AUDREY Y	
ART UNIT	**PAPER NUMBER**
2872	

DATE MAILED: 06/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/662,316	Applicant(s) PARK, CHAN YOUNG	
	Examiner Audrey Y. Chang	Art Unit 2872	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 12 April 2006.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 16,19-28,30,31 and 34-42 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 16,19-28,30,31 and 34-42 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Remark

- This Office Action is in response to applicant's amendment filed on April 12, 2006, which has been entered into file.
- By this amendment, the applicant has amended claims 16, 20, 22, 24-25, 30, 37, 39, and 40.
- Claims 16, 19, 20-28, 30-31, and 34-42 remain pending in this application.

Drawings

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "optical waveguide comprises a plurality of light guiding cores," recited in **claim 28** must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Applicant fails to address such objection to the drawings.

Response to Amendment

2. The amendment filed **April 12, 2006** is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: **Claims 16 and 31 have been amended** to include the feature "a refractive index of the liquid crystal holographic optical element and an angle of incidence of the input light *do not satisfy total internal reflection criterion*".

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. **Claims 16, 19-28, 30-31, and 34-42 are rejected under 35 U.S.C. 112, first paragraph**, as based on a disclosure which is not enabling. The *conditions* of having the refractive index of the liquid crystal holographic optical element to be **greater** than the refractive index of the waveguide **and** the light incident on the liquid crystal holographic optical element must be ***greater*** than a *critical angle* in order for the light to be reflected back to the optical waveguide *via total internal reflection* are critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). A liquid crystal holographic optical element will not be able to reflect the light back to the waveguide *via total internal reflection* by itself. The conditions set forth above are the *necessary criterions* for the total internal reflection to occur. Furthermore, the

claims fail to provide *how* does the hologram of the liquid crystal holographic optical element is *switched* or "selectively *adjustable*" in order for the light to be *reflected back* to the optical waveguide via total internal reflection. The liquid crystal holographic optical element **cannot** cause total internal reflection of the light. Rather the liquid crystal holographic optical element is being switched to have a uniform refractive index, (i.e. no hologram formed in this state), wherein the refractive index is being *greater* than the refractive index of the waveguide and the when the light incident on the hologram is *greater* than a critical angle, which is determined by refractive indices of both the liquid crystal material and the waveguide, then the total internal reflection can occur at the interface. Total internal reflection means the light does not travel to the liquid crystal holographic optical element at all. The claims also **fail** to teach how does the hologram is **adjusted** to have at least some of the input light to be transmitted through the liquid crystal holographic optical element. The liquid crystal material has to be adjusted to form *refractive index bands*, or *grating structure* with alternative refractive indices in alternative regions, therefore forms a hologram, wherein the refractive indices of the liquid crystal holographic optical element and incident angle of the light do not satisfy the total internal reflection criterions so that the light enters the holographic optical element and is diffracted by the element.

The amendment to the claims (claims 16 and 30) concerning the phrase "a refractive index of the liquid crystal holographic element and an angle of incident of the input light" does NOT resolve the rejection since by merely claiming the element has certain refractive index DOES NOT give total internal reflection. The applicant is respectfully reminded the criterions for setting up total internal reflection are stated explicitly above.

Applicant is respectfully noted that for a medium having a refractive index and an incident light having an incident angle are not the critical condition that "inherently" a total internal reflection will occur. Every optical medium has a refractive index and if a light incident on the optical medium it will have an incident angle, however this does not mean a total internal reflection

will occur. The total internal reflection is not an inherent property for any optical medium having a refractive index and for light having an incident angle.

5. **Claims 16, 19-28, 30-31, and 34-42 are rejected under 35 U.S.C. 112, first paragraph,** as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The reasons for rejection based on the *newly added matters* are set forth in the paragraph above.

Claim Objections

6. **Claims 16, 19-28, 30-31, and 34-42 objected to because of the following informalities:**

(1). **Claims 16 and 31 have been amended** to include the feature "total internal reflection criterions" that is confusing and indefinite since it is not clear what are these total internal reflection criterions and it is not clear the total internal reflection occurs at where.

(2). The phrase "a plurality of light guiding cores" recited in claim 28 is confusing and indefinite since it is not clear how does this "plurality of light guiding cores" relate to the liquid crystal holographic optical element. *(This objection is repeated from the previous Office Action).*

(3). The phrase "an index of refraction of the liquid crystal holographic optical element in the first state is substantially the same as the index of refraction of the at least one cladding layer" recited in claim 31 is confusing and indefinite since it is not clear how does this feature has anything to do with the device. There lacks logical relationship to make the scope of the claim clear. *(This objection is repeated from the previous Office Action).*

Appropriate correction is required.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. **Claims 16 and 23-27 are rejected under 35 U.S.C. 102(b) as being anticipated by the patent issued to Izumi et al (PN. 5,452,385).**

Izumi et al teaches a *display device* (Figure 5) that is comprised of a *light guide medium* that serves as the *light guiding core* for an *optical waveguide* for *receiving* and *guiding* light (as shown in Figure 5), a set of *first electrode* (43a-43d) positioned on the waveguide, a liquid crystal medium (42) incorporated with a *holographic diffraction grating* (44), that together serves as the *liquid crystal holographic optical element*, positioned on the first set of the electrode and a second set of electrode (45) positioned on the liquid crystal holographic optical element. The first and second sets of the electrodes defined pixel areas for the display device.

Izumi et al teaches that by applying a *non-zero electrical field* across the liquid crystal holographic optical element, the liquid crystal molecules will be oriented to be aligned so that a refractive index of the medium or the liquid crystal holographic optical element is set up to be *greater* than the refractive index of the light guiding core (41) so that the light will transmit through the guiding core and reached to the holographic diffractive grating and being diffracted out of the display device, (please see electrode 43c in Figures 5 and 7b). Izumi et al also teaches if *no electrical field* is set across the liquid crystal holographic optical element, the liquid crystal molecules are *not oriented* and effective refractive index of the liquid crystal holographic optical element has a value that is *less than* the refractive index of

the light guiding core, the light will then be *totally reflected* at the boundary of the light guiding core (41) and the liquid crystal holographic optical element and being transmitted *only through the core* and not reaching the holographic diffractive grating. In this manner, the holographic diffraction grating is selectively adjustable between the state of having light reached it to be diffracted and a state having no light reached it to be diffracted out of the display device, (please Figures 5, 7a-7c, columns 8-9, transmission mode of the display device is explicitly stated in column 9 lines 50-56).

Claim 16 has been amended to include the phrase "at least one hologram is formed in the liquid holographic optical element such that a refractive index of the liquid crystal holographic element an angle of incidence of the input light do not satisfy total internal reflection criterion". Izumi et al teaches that by applying a non-zero electrical field across the liquid crystal holographic optical element the liquid crystal molecules are oriented so that the refractive index of the liquid crystal holographic optical element is greater than the refractive index of the light guide which means the total internal reflection criterion at the interface of the light guide and the liquid crystal holographic element is destroyed or not satisfied. The holographic diffraction grating formed within is then activated to diffract the incident light.

With regard to claims 24-25, Izumi et al teaches that the voltage or electrical field can be selectively applied across certain electrodes, therefore pixel area, to cause the light to transmit through the area. Since the degree of orientation of the molecules are based on the magnitude of the applied voltage or electrical field, the percentage of the light transmitted through the areas can be adjusted by the magnitude of the electrical field applied.

With regard to claim 26, Izumi et al teaches to use a light source (47) for generating the input light.

With regard to claim 27, the light guiding core (40) has an area that is the same as the effective display area of the display device, (please see Figure 5).

This reference has therefore anticipated the claims.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Izumi et al.

The display device taught by **Izumi** et al as described for claim 16 above has met all the limitations of the claim with the exception that this reference does not each explicitly about having a plurality of light guiding cores. However the specification and claims also fail to teach what are the structural and logical relationships between the "plurality of guiding cores" and the display device recited in claim 16, such feature can only be examined in the broadest interpretation. It would certainly having been obvious to one skilled in the art to use more than one of the display device having a light guiding core as shown in Figure 5 to make a larger display device for displaying larger image information.

11. Claims 30-31, and 38-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Izumi et al in view of the patent issued to Rockwell et al (PN. 5,106,181).

Izumi et al teaches a *display device* (Figure 5) that is comprised of a *light guide medium* that serves as the *light guiding core* for an *optical waveguide* for *receiving* and *guiding* light (as shown in Figure 5), a set of *first electrode* (43a-43d) positioned on the waveguide, a liquid crystal medium (42) incorporated with a *holographic diffraction grating* (44), that together serves as the *liquid crystal holographic optical element*, positioned on the first set of the electrode and a second set of electrode (45)

positioned on the liquid crystal holographic optical element. The first and second sets of the electrodes defined pixel areas for the display device.

Izumi et al teaches that by applying a non-zero electrical field across the liquid crystal holographic optical element, the liquid crystal molecules will be oriented to be aligned so that a refractive index of the medium or the liquid crystal holographic optical element is set up to be *greater* than the refractive index of the light guiding core (41) so that the light will transmit through the guiding core and reached to the holographic diffractive grating and being diffracted out of the display device, (please see electrode 43c in Figures 5 and 7b). Izumi et al also teaches if *no electrical field* is set across the liquid crystal holographic optical element, the liquid crystal molecules are *not oriented* and effective refractive index of the liquid crystal holographic optical element has a value that is *less than* the refractive index of the light guiding core, the light will then be *totally reflected* at the boundary of the light guiding core (41) and the liquid crystal holographic optical element and being transmitted *only through the core* and not reaching the holographic diffractive grating. In this manner, the holographic diffraction grating is selectively adjustable between the state of having light reached it to be diffracted and a state having no light reached it to be diffracted out of the display device, (please Figures 5, 7a-7c, columns 8-9, transmission mode of the display device is explicitly stated in column 9 lines 50-56).

This reference has met all the limitations of the claims with the exception that it does not teach explicitly that the light guiding core (40) is on a *cladding layer*. However it is rather well known in the art of waveguide to use a cladding layer for enhancing the total internal reflection function of the light transmitting within the waveguide as shown by **Rockwell** et al in an optical waveguide display system wherein the *core guiding layer* (22, Figure 4) is formed on a cladding layer (20 and 24 Figure 4) for enhancing the total internal reflection of the light at the boundary surface of the core and cladding layer, (please see column 9, lines 23-43). Such modification therefore would have been obvious to one skilled in the art for the benefit of enhancing the light transmission property within the waveguide core layer.

Claim 30 has been amended to include the phrase "at least one hologram is formed in the liquid holographic optical element such that a refractive index of the liquid crystal holographic element an angle of incidence of the input light do not satisfy total internal reflection criterion". Izumi et al teaches that by applying a non-zero electrical field across the liquid crystal holographic optical element the liquid crystal molecules are oriented so that the refractive index of the liquid crystal holographic optical element is greater than the refractive index of the light guide which means the total internal reflection criterion at the interface of the light guide and the liquid crystal holographic element is destroyed or not satisfied. The holographic diffraction grating formed within is then activated to diffract the incident light.

With regard to claims 39-40, Izumi et al teaches that the voltage or electrical field can be selectively applied across certain electrodes, therefore pixel area, to cause the light to transmit through the area. Since the degree of orientation of the molecules are based on the magnitude of the applied voltage or electrical field, the percentage of the light transmitted through the areas can be adjusted by the magnitude of the electrical field applied.

With regard to claim 41, Izumi et al teaches to use a light source (47) for generating the input light.

With regard to claim 42, the light guiding core (40) has an area that is the same as the effective display area of the display device, (please see Figure 5).

12. Claims 16, and 19-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Date (PN. 6,6,18,104).

The newly amended claims have necessitated the new ground of rejections.

Date et al teaches an *optical display device* having a *light guide* (204, Figures 21A, 2A, 6-11) serve as the *light guiding core* of an *optical waveguide* for receiving and guiding light having a *first set of*

electrodes (201) formed on the waveguide and an *optical control layer* having *holographic PDLC* (PDLC stands for polymer dispersed liquid crystal) serves as the *liquid crystal holographic optical element* (200) positioned on the first set of electrode and a *second* set of electrode (203) positioned at the second side of the liquid crystal holographic optical element, (please see Figure 21A), such that the first and second sets of the electrode defines pixel areas for the display device.

Date et al teaches by applying different voltage across the liquid crystal holographic optical element the element can be switched to a *diffraction state* (result of a first effective refractive index of the element) and a *transmission state* (result of a second effective refractive index of the element). In particularly, **(with regard to claim 23)**, Date et al teaches that when *no voltage* is applied across the electrodes, the liquid crystal holographic optical element is switched to a transmission state such that the incident light with an incidence angle is transmitted through the liquid crystal holographic optical element is totally reflected by a low refractive index layer (202, please see column 30, lines 28-32) back to the light guide or waveguide. Date et al teaches that when a non-zero electrical field is applied across the electrodes (selected areas of the electrode such as 203') the liquid crystal holographic optical element is activated so that a hologram is formed and the light incident from the waveguide will not satisfy total reflection criterions and the incident light is diffracted by the hologram of the liquid crystal holographic element to produce an image, (please see Figure 21A and 21B).

This reference has met all the limitations of the claims with the exception that it does not teach explicitly that the second set of electrode is on the liquid crystal holographic optical element. However whether to have the electrodes *on* (means in contact) or *at the side of the* liquid crystal holographic optical element is considered to be obvious matters of design choice to one skilled in the art for they achieve the same function namely defining the pixels areas and individually addressed the pixel areas of the liquid crystal holographic optical element to switch it between transmission state and diffraction state.

With regard to claims 19-22, Date et al teaches that a full color image display device can be achieved by preparing three colors (red, green and yellow) for light sources and switching the light source color in *synchronized* with *display pixels*, which implies the pixel areas comprise sub-pixels of red, green and yellow, (please see column 24, lines 51-56). Although this reference teaches that the colors to be red, green and yellow, however one skilled in the art would understand the full color is achieved by using primary colors namely red, green and blue such modification is considered to be obvious matters of design choices to one skilled in the art to achieve the same function, namely fully color image display. Date et al further teaches that the holographic PDLC or the liquid crystal holographic optical element comprises volume holograms that are *wavelength selective* which means that for making the fully color display, holograms for respectively diffracting light of red, green and yellow or blue colors have to be included to make the full color image display possible, (please see column 18, lines 12-19).

With regard to claim 24-25, Date et al teaches that the liquid crystal holographic optical element is switched between transmission state and diffraction state by varying the value of the voltage applied across the liquid crystal holographic optical element. Since the orientation and the order of the dispersed liquid crystal molecules are a function of the value of the applied voltage or electrical field, by continuously varying the applied voltage, different transmittance of the light can be achieved. And the light for reaching the selected areas of the electrodes can be adjusted between the 0% (where diffractive state is the fullest) to 100% when the no diffraction occurs.

With regard to claims 26, it is implicitly true that there is a light source for generating the input light.

With regard to claim 27, the substrate waveguide, (Figures 21A and 21B, and 12 and 13), serves as the light guiding core and has an area that can be identified as effective display area.

With regard to claim 28, these references do not teach explicitly that the optical waveguide comprises a plurality of light guiding cores. However it would have been obvious to one skilled in the art

to combine a plurality of the waveguide with the output holographic optical elements disposed upon it (such as Figures 11-13) for the benefit of making a larger display device.

13. Claims 30-31, and 34-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Date et al and in view of the patent issued to Rockwell et al (PN. 5,106,181).

The newly amended claims have necessitated the new ground of rejections.

Date et al teaches an *optical display device* having a *light guide* (204, Figures 21A, 2A, 6-11) serve as the *light guiding core* of an *optical waveguide* for receiving and guiding light having a *first set of electrodes* (201) formed on the waveguide and an *optical control layer* having *holographic PDLC* (PDLC stands for polymer dispersed liquid crystal) serves as the *liquid crystal holographic optical element* (200) positioned on the first set of electrode and a *second* set of electrode (203) positioned at the second side of the liquid crystal holographic optical element, (please see Figure 21A), such that the first and second sets of the electrode defines pixel areas for the display device.

Date et al teaches by applying different voltage across the liquid crystal holographic optical element the element can be switched to a *diffraction state* (result of a first effective refractive index of the element) and a *transmission state* (result of a second effective refractive index of the element). In particularly, **(with regard to claim 38)**, Date et al teaches that when *no voltage* is applied across the electrodes, the liquid crystal holographic optical element is switched to a transmission state such that the incident light with an incidence angle is transmitted through the liquid crystal holographic optical element is totally reflected by a low refractive index layer (202, please see column 30, lines 28-32) back to the light guide or waveguide. Date et al teaches that when a non-zero electrical field is applied across the electrodes (selected areas of the electrode such as 203') the liquid crystal holographic optical element is activated so that a hologram is formed and the light incident from the waveguide will not satisfy total

reflection criterions and the incident light is diffracted by the hologram of the liquid crystal holographic element to produce an image, (please see Figure 21A and 21B).

This reference has met all the limitations of the claims with the exception that it does not teach explicitly that the second set of electrode is on the liquid crystal holographic optical element. However whether to have the electrodes *on* (means in contact) or *at the side of the* liquid crystal holographic optical element is considered to be obvious matters of design choice to one skilled in the art for they achieve the same function namely defining the pixels areas and individually addressed the pixel areas of the liquid crystal holographic optical element to switch it between transmission state and diffraction state.

Furthermore, Date et al does not teach explicitly that the light guiding core (204) is on a *cladding layer*. However it is rather well known in the art of waveguide to use a cladding layer for enhancing the total internal reflection function of the light transmitting within the waveguide as shown by **Rockwell** et al in an optical waveguide display system wherein the *core guiding layer* (22, Figure 4) is formed on a cladding layer (20 and 24 Figure 4) for enhancing the total internal reflection of the light at the boundary surface of the core and cladding layer, (please see column 9, lines 23-43). Such modification therefore would have been obvious to one skilled in the art for the benefit of enhancing the light transmission property within the waveguide core layer.

With regard to claim 31, Date et al teaches that at the first state when there is no diffraction occurs the liquid crystal holographic optical element seems to have the same refractive index as the waveguide or light guise assembly such that the include light passes through the interface of the two without any refraction, (please see Figures 21A and 21B). This requires the cladding layer has the refractive index that matches the refractive index of the liquid crystal holographic optical element.

With regard to claims 34-37, Date et al teaches that a full color image display device can be achieved by preparing three colors (red, green and yellow) for light sources and switching the light source color in *synchronized* with *display pixels*, which implies the pixel areas comprise sub-pixels of red, green

and yellow, (please see column 24, lines 51-56). Although this reference teaches that the colors to be red, green and yellow, however one skilled in the art would understand the full color is achieved by using primary colors namely red, green and blue such modification is considered to be obvious matters of design choices to one skilled in the art to achieve the same function, namely fully color image display. Date et al further teaches that the holographic PDLC or the liquid crystal holographic optical element comprises volume holograms that are *wavelength selective* which means that for making the fully color display, holograms for respectively diffracting light of red, green and yellow or blue colors have to be included to make the full color image display possible, (please see column 18, lines 12-19).

With regard to claim 39-40, Date et al teaches that the liquid crystal holographic optical element is switched between transmission state and diffraction state by varying the value of the voltage applied across the liquid crystal holographic optical element. Since the orientation and the order of the dispersed liquid crystal molecules are a function of the value of the applied voltage or electrical field, by continuously varying the applied voltage, different transmittance of the light can be achieved. And the light for reaching the selected areas of the electrodes can be adjusted between the 0% (where diffractive state is the fullest) to 100% when the no diffraction occurs.

With regard to claims 41, it is implicitly true that there is a light source for generating the input light.

With regard to claim 42, the substrate waveguide, (Figures 21A, 21B and 11-13), serves as the light guiding core and has an area that can be identified as effective display area.

Response to Arguments

14. Applicant's arguments filed on April 12, 2006 have been fully considered but they are not persuasive. The newly amended claims have been fully addressed and they are rejected for the reasons stated above.

15. In response to applicant's arguments concerning the 35 USC 112 first paragraph rejection, which state that the features that are critical are included in the claims that "once the critical features are recited the physical conditions that must be present are by definition inherent", the examiner respectfully disagrees since the claims simply fail to disclose the critical features and criterion for total internal reflection to occur. The claims only recite the liquid crystal holographic element has a refractive index and the input light has an angle of incidence. However EVERY medium has a refractive index and EVERY input light has an angle of incidence that does not make EVERY input light totally reflected. The applicant being one skilled in the art must know that the critical criterions for allowing total internal reflection is more than just a refractive index and a incidence angle of the input light. Also the claims fail to disclose the structural relationship between the cladding layer and the liquid crystal holographic optical element and the claims fail to disclose at what interface is this total internal reflection is considered, the refractive index of the cladding layer therefore means nothing but an arbitrary feature.

16. In response to applicant arguments which states that the cited *Izumi* fails to disclose a "liquid crystal holographic optical element" the examiner respectfully disagrees since Izumi disclose a liquid crystal medium (42) incorporated with a *holographic diffraction grating* (44), that **together** serves as the *liquid crystal holographic optical element*, and has the same function as the claimed "liquid crystal holographic optical element" as the instant application, (please see the reasons for rejection above). Applicant's argument concerning the holographic diffraction grating is a static set and a separate set in the Izumi reference are irrelevant since the **claims** fail to disclose if the diffraction grating is a static set or not and it or is not separate. The combined holographic diffraction grating and the liquid crystal medium of Izumi **together** is being switched between a state where incident light is reflected back to the waveguide by total internal reflection and a state wherein the diffraction grating is "activated" in function therefore formed to diffract the incident light.

Conclusion

17. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Audrey Y. Chang whose telephone number is 571-272-2309. The examiner can normally be reached on Monday-Friday (8:00-4:30), alternative Mondays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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